

ART. I.—*Victorian and South Australian Shallow-Water Foraminifera.—Part I.*

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(With Plate I.)

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Introduction.

For several years the writer has been engaged in the study of the coastal foraminifera of Victoria and South Australia, and the present contribution is the first of a series which are intended to deal with the new and more interesting species.

The foraminifera of this area are comparatively well known as a result of the researches of Parker and Jones (*Phil. Trans.*, clv, 1865, p. 438), Howchin (*Trans. R. Soc. S.A.*, xiii, 1890, pp. 161-169), and Chapman (*Journ. Quack. Micr. Club*, [2], x (for 1907), 1909, pp. 117-146, pls. ix, x). It may be mentioned here that the locality given by Parker and Jones for one list (No. 30) is almost certainly not Melbourne nor elsewhere on the Victorian coast, but probably on the coast of South Australia. Two of the species listed, *Valvulina polystoma* and *V. mixta*, have not occurred in any of my material from Victoria, while others mentioned are much commoner in South Australian waters.

With one or two exceptions, which will be noted later, all of the species figured are from one or more of the following localities:—

- Station 1.—San Remo, Vic. Shore sand (collected by W.J.P.).
- Station 2.—Westernport Bay, Vic. A shallow-water dredging (dredged by C. J. Gabriel).
- Station 3.—Black Rock, Vic. Anchor mud (collected by A. C. Collins).
- Station 4.—Williamstown. Silty mud (collected many years ago by the late J. Gabriel).
- Station 5.—St. Leonard's, Vic. Shore sand (collected by W.J.P.).
- Station 6.—Point Lonsdale, Vic. Several samples of shore sand collected at various dates by my father, W. G. Parr.
- Station 7.—Torquay, Vic. Shore sand (collected by A. C. Collins).
- Station 8.—Port Fairy, Vic. Shore sand (collected by F. Chapman).
- Station 9.—Glenelg, S.A. Two samples of shore sand.
- Station 10.—Gulf St. Vincent, S.A., from the *Posidonia* deposit (collected by D. J. Mahony).
- Station 11.—Hardwicke Bay, S.A. Shore sand.

In the systematic portion of this paper, only the station numbers are given. The letters P, and J., H., or C., placed after the station numbers, indicate that the species has been recorded previously in the papers of Parker and Jones, Howchin, or Chapman.

I am indebted to my friend, Mr. Frederick Chapman, the Commonwealth Paleontologist, for suggesting the writing of these notes, and providing much of the material studied. He has also given me the benefit of his experience in settling several problems. To another collaborator, Mr. Arthur C. Collins, A.R.V.I.A., I owe the dredging from off Black Rock and the shore gathering from Torquay. Mr. Collins has also drawn the plates illustrating this paper. My father, Mr. W. G. Parr, collected the rich shore sand from Point Lonsdale.

The classification followed is that recently published by Dr. J. A. Cushman.

Systematic Description of Species.

Order FORAMINIFERA.

Family SACCAMMINIDAE.

Sub-Family SACCAMMININAE.

Genus *Proteonina* Williamson, 1858.

PROTEONINA SPICULIFERA, sp. nov.

(Plate I, Fig. 1.)

Description.—Test free, consisting of a single fusiform chamber, broadest in the lowest third, and tapering towards the circular aperture; wall composed of a single layer of coarse acerose sponge spicules arranged more or less longitudinally, with some sand grains of different sizes, most of which are built into the early part of the shell, the whole firmly cemented with a small quantity of brown cement; colour of test brown. Length up to 2.1 mm.

Holotype (Parr Coll.) from shore sand, Point Lonsdale, Vic., collected by W. G. Parr.

Remarks.—This species seems to be quite distinct from other members of the genus. *P. hystrix* (Egger), described (*Abh. bay. Akad. Wiss. München*, xviii, 1893, p. 256, pl. iv, fig. 14), from off the Cape Verde Islands, 69 metres, also uses sponge spicules in the construction of its test, but is otherwise a very different form. Except for its partially spicular shell wall, the present species is much like Williamson's *P. fusiformis*, the type species of the genus. The outline of one specimen is suggestive of the genus *Nouria*, but the test in the examples found is undivided. The only locality at which *P. spiculifera* occurred was Point Lonsdale, in shore sand collected by my father. It was rare here.

Family REOPHACIDAE.

Genus *Reophax* Montfort, 1808.*REOPHAX SCORPIURUS* Montfort (?).

(Plate I, Fig. 3.)

Stns. 6, 8. C.

There are several examples agreeing closely with Fig. 16 of Plate xxx of the "Challenger" Report, which Brady records as *R. scorpiurus*. This form is common on the eastern coast of Australia. Brady's example was from off Raine Island, Torres Strait, 155 fms. Comparison of this with Soldani's figure on which Montfort based his species (*vide Ann. Mag. Nat. Hist.* [4], viii, 1871, pl. ix, fig. 29, where Soldani's figure is reproduced), discloses that our form is of irregular outline and obscurely segmented, while Soldani's figure represents a neatly built, distinctly chambered test, apparently of a different species. His specimens were from the Mediterranean. *R. scorpiurus* may be a very variable species, but until more is known of its mode of occurrence in the type region, it seems best to regard the Australian form as possibly distinct. Hada (*Trans. Sapporo Nat. Hist. Soc.*, xi (1), 1929, p. 10, text-figs. a-d) has recently described a new species, *R. enormis*, from the coast of Japan, which resembles the Australian form more closely. It may be distinguished from the latter by its fewer (three) chambers and the produced apertural neck.

REOPHAX FRIABILIS, sp. nov.

(Text-fig. 1A; Plate I, Figs. 2a, b.)

Description.—Test in the megalospheric form consisting of about five chambers increasing slightly in size as added; in the microspheric stage there are up to eight chambers increasing rapidly in size, the chambers in both forms being arranged in a straight or slightly curved series; chambers about as long as broad; the segmentation of the test is obscure from the exterior, but broken specimens show it to be as in the genus *Reophax*; wall thick, composed of fairly large sand grains of even diameter, rather loosely cemented, especially in the last-formed chamber, with a small amount of brown cement; apertural end truncate; aperture rounded, without a definite neck; colour of test brown.

Length of holotype, a microspheric specimen, 3.9 mm.; greatest diameter, 0.98 mm.; length of larger megalospheric example, 3.5 mm.; diameter of last-formed chamber, 1 mm.

Holotype (Parr Coll.) from shore sand, Point Lonsdale, Vic., collected by W. G. Parr.

Remarks.—Five examples, one megalospheric and the others microspheric, were found in the Point Lonsdale gathering. The occurrence of such a large proportion of microspheric specimens

is unusual. I have another example of the megalospheric stage from a dredging made by Dr. Verco off the coast of South Australia. The most nearly related species appears to be *R. insectus* Goës (*Bull. Mus. Comp. Zool. Harvard*, xxix, No. 1, 1896, p. 28, pl. iii, figs. 6, 7), described from off the W. coast of Mexico and from near the Galapagos Islands, 772-795 fms., and also recorded by Cushman (*Bull.* 71, *U.S. Nat. Mus.*, pt. 1, 1910, p. 89, text-fig. 124) from off San Diego, California, 617-680 fms. This is a larger species, reaching 8 mm. in length, the diameter of the last-formed chamber ranging from 1.5 mm. to 2 mm. It also has more chambers, the specimen figured by Goës having twelve which are separated by very distinct sutures. Goës notes that the aperture of his species is often slightly limbated or protruding.

Family VERNEUILINIDAE.

Genus *Clavulina* d'Orbigny, 1826.

CLAVULINA MULTICAMERATA Chapman.

(Plate I, Figs 4, 5.)

Clavulina parisiensis d'Orbigny, var. *multicamerata* Chapman, 1909.
Journ. Quek. Micr. Club, [2], x (for 1907), p. 127, pl. ix, fig. 5.
Stns. 1, 2, 7, 8, 9, 11. C.

This form was described by Mr. Chapman from Shoreham, Vic., and has proved to be quite common on the Victorian coast. The shell wall in all of the examples, except those from Westernport Bay, where the specimens are also slenderer, is largely constructed of small fragments of sponge spicules, the longest of which are built in along the suture lines of the chambers. In the majority of specimens, the first three or four chambers of the uniserial series are roughly triangular in section. This character is illustrated by the figured examples, and is also suggested by Mr. Chapman's figure. Specimens which have not passed this stage of growth are very like Sidebottom's figure (*Mem. Proc. Manchester Lit. Phil. Soc.*, liv (3), 1910, p. 11, pl. i, fig. 10), of *Clavulina angularis* d'Orb., from Palermo, Sicily, which is itself very close to d'Orbigny's type figure (*Ann. Sci. Nat.*, vii, 1826, p. 268, No. 2, pl. xii, fig. 7) of that species. It is of interest to note that Parker and Jones recorded *C. parisiensis* and *C. angularis* (as *Valulina*) from coast sand, Melbourne, Australia. Probably the present form was that met with.

C. multicamerata was originally described as a variety of *C. parisiensis*, but after comparing the much larger number of specimens now available, including some from the type sample, with examples of *C. parisiensis* from the Eocene of the Paris Basin, and *C. angularis* from the Mediterranean, I think it should be given specific rank.

CLAVULINA DIFFORMIS Brady.

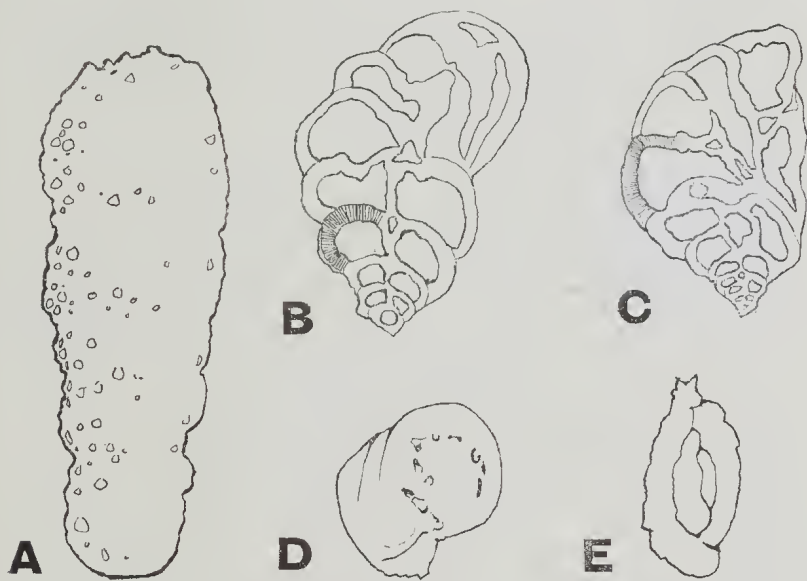
(Plate I, Fig. 6.)

Clavulina angularis d'Orbigny, var. *difformis* Brady, 1884, *Rept. Voy. "Challenger," Zool.*, vol. ix, p. 396, pl. xlviii, figs. 25-31.

C. difformis Brady: Cushman, 1924, *Publ. 342, Carn. Inst. Wash.*, p. 23, pl. vi, figs. 5, 6.

Stns. 1, 2, 8, 10, 11, and Shoreham, Vic.

This rare form was described from Nares Harbour, Admiralty Islands; the only other records are from the Kerimba Archipelago, off Portuguese East Africa (Heron-Allen and Earland), Guam and Samoa (Cushman). The figured example is from Gulf St. Vincent, where the species is common, and the specimens exceptionally fine.



Text-Figure I.

A—*Reophax friabilis*, sp. nov. Megalospheric example from Point Lonsdale, Vic., $\times 21$. B—*Cribobulimina polystoma* (Parker and Jones). Megalospheric form from Gulf St. Vincent, S.A., $\times 37$, vertical section. C—Microspheric form of same, $\times 27$, vertical section. D—*Cribobulimina polystoma* (Parker and Jones), from Gulf St. Vincent, S.A., $\times 21$. E—*Quinqueloculina ammophila*, sp. nov. from Western Port Bay. Front aspect, $\times 21$.

Family VALVULINIDAE.

Genus *Criobulimina* Cushman, 1927.

CRIBROBULIMINA POLYSTOMA (Parker and Jones).

(Text-fig. 1, B.C.D.; Plate I, Figs. 7a, b.)

Valvulina spp. Parker and Jones, in Carpenter, Parker and Jones, 1862, Introd. Foram., p. 147, pl. xi, figs. 19, 20, 21, 24, 25, 26.*V. polystoma* Parker and Jones, 1865, *Phil. Trans.*, clv, pp. 437, 438.*V. mixta* Parker and Jones, 1865, *op. cit.*, p. 438.*Criobulimina mixta* (Parker and Jones): Cushman, 1927, *Contribs. Cush. Lab.*, ii (4), p. 80, pl. xi, figs. 1-5.

Stns. 9, 10, 11. P. & J.

Description.—Test in the early stages trihedral, angled, the sides flattened, chambers triserially arranged, adult chambers in a loose spiral, five or more in a coil; sutures distinct; wall arenaceous; aperture in the young as in *Valvulina*, later developing an opening in the plate-like tooth and in the adult a series of small openings forming a cribrate plate.

Remarks.—The above is Dr. Cushman's description of the genus *Criobulimina*, *C. mixta* being selected by him as the genotype. The type material was from Australia.

Although this species was first figured in 1862, it was not until three years later that Parker and Jones named it in their paper on foraminifera from the North Atlantic and Arctic Oceans (*op. cit. supra*). On page 437 of this work, a list of foraminifera from "Swan River, white shelly mud, 7-8 fms." is given, and in this the occurrence of *Valvulina polystoma* is recorded, the name being applied, in a footnote, to figs. 21 and 24 of Plate xi of Carpenter's "Introduction." Fig. 21 represents a short, very broad specimen, in which the early triangular growth is almost completely hidden by the later coiled series of chambers, and the aperture is cribrate. A similar example is here figured (Text-fig. 1D).

On page 438, another list, from "coast sand, Melbourne, Australia," appears. Here in addition to *V. polystoma*, another species, *V. mixta*, is recorded, this name being given to figs 19, 20, 25 and 26 of Plate xi of the "Introduction." This form has an aperture with a simple valvular tooth, and is about twice as long as wide. This type of shell is figured on Plate I. of the present paper. (Figs. 7a, b.)

In the sample of material from the *Posidonia* deposit in Gulf St. Vincent, examples of both forms occur, that named by Parker and Jones, *Valvulina mixta*, being extremely common. Because of their association here and at other localities and the comparative rarity of the short, broad type of shell, it appeared likely that the two represented the megalospheric and microspheric stages of the one species. Sections made of a number of specimens prove this to be the case, the so-called *V. mixta* being the megalospheric

stage and *V. polystoma* the microspheric. (Text-figs. 1B and 1C.) *V. mixta* is therefore a synonym of the previously-named *V. polystoma*. Within well-defined limits, represented by figs. 19 and 21 of Carpenter's "Introduction," the species is very variable in form. Some of the intermediate forms have been figured by Dr. Cushman (*loc. cit.*).

The writer's sections confirm Carpenter's statement as to the presence of two shell layers. The inner, or perforate layer, is by far the thicker. The outer is often practically absent, particularly in the earlier chambers, and is seldom more than a mere film of sand grains. The inner layer is closely tubulated, the tubules being clearly visible under a magnification of 40 diameters. Although tests with acid show the shell to be almost entirely calcareous in its composition, the inner layer does not appear to be wholly secreted by the organism, but to consist of minute grains of adventitious material embedded in abundant calcareous cement. The material forming the outer layer is largely quartz sand.

The only records of this interesting species are those given above. They are all from shallow water. The writer has met with *C. polystoma* in an "Endeavour" dredging from 30 miles S. of Cape Nelson, Vic., 300 fms., and it is not uncommon in some soundings made by the trawler "Bonthorpe" in the Great Australian Bight, off the coast of West Australia, at depths of about 100 fms. As a fossil it occurs with *Marginopora vertebralis* Q. and G., in the Lower Pleistocene limestone of Yorke Peninsula, South Australia.

Family MILIOLIDAE.

Genus *Quinqueloculina* d'Orbigny, 1826.

QUINQUELOCULINA AUSTRALIS, sp. nov.

(Plate I, Figs. 8a-c.)

Miliolina subrotunda Brady (*non Vermiculum subrotundum* Montagu), 1884, *Rept. Voy. "Challenger," Zool.*, vol. ix, pl. v, figs. 10, 11.

Description.—Test in front view rounded, as long as broad; chambers roughly triangular in transverse section, especially in the early portion of the test, with the wall thickened on the outside angle; periphery subangular, but occasionally rounded; sutures distinct, not depressed; surface smooth; aperture semicircular, with a tooth of the same shape a little in front of the aperture.

Length up to 0.5 mm.; thickness, 0.24—0.3 mm.

Holotype (Parr Coll.) from 7 miles E. of Cape Pillar, Tas., 100 fms. Other examples are from shore sand, Point Lonsdale, Vic., and from several dredgings from depths of about 100 fms. off the coast of New South Wales and in the Great Australian Bight. The specimens figured by Brady were from "Challenger" Station 162, off East Moncoeur Island, Bass Strait, 38 fms.

Remarks.— The figures give an excellent idea of the characters of this species. Related species are *Q. dilatata* d'Orb., also found on the coast of Victoria, and *Q. subrotunda* (Montagu), described from the coast of Great Britain. These are more compressed, less regularly formed, and have a rounded margin at all stages of development. The thickened outside angle of the chambers, amounting in many cases to almost a broad keel, particularly in the early stages, is a very distinctive feature of the present species. The slightly oblique early chambers are also characteristic.

QUINQUELOCULINA COSTATA d'Orbigny.

(Plate I, Fig. 9.)

Quinqueloculina costata d'Orbigny, 1826, *Ann. Sci. Nat.*, vii, p. 301, No. 3. Schlumberger, 1893, *Mém. Soc. Zool. France*, vi, p. 69, text-fig. 20; pl. iii, figs. 75, 76. Fornasini, 1905, *Mem. Acc. Sci. Ist. Bologna*, [6], ii, p. 62, pl. ii, figs. 6a-c.

Miliolina costata (d'Orb.): Heron-Allen and Earland, 1915, *Trans. Zool. Soc. London*, xx, p. 579, pl. xlv, figs. 9-12.

Stn. 1.

There is one specimen agreeing with Schlumberger's figures and description of this species. His specimens were from the Gulf of Marseilles, 30-40 metres, while those of d'Orbigny were also from the Mediterranean Sea. The figures in the Planches Inédites show a slenderer shell more like those from the Kerimba Archipelago, figured as this species by Heron-Allen and Earland, except that the apertural tooth appearing in d'Orbigny's and Schlumberger's figures is absent from the Kerimba specimens.

QUINQUELOCULINA AMMOPHILA, sp. nov.

(Plate I, Figs. 10a, b; Text-fig. 1E.)

Description.—Test elongate-ovate, about twice as long as broad, somewhat flattened; chambers rounded in cross section, distinct; sutures depressed; wall composed of coarse sand grains; apertural end produced, aperture circular, with a small plate-like tooth.

Length up to 1.3 mm.

Holotype (Parr Coll.) from Westernport Bay, dredged by C. J. Gabriel.

Remarks.—This form was common at the type locality. I have other specimens from Port Fairy, Vic. (Stn. 8), and from two "Bonthorpe" soundings in the Great Australian Bight, at depths of 89 and 75 fms. It is extremely common in the Lower Pliocene of the Lake Bunga district, near Lakes Entrance, Vic.

There are several other species with agglutinated tests which have been recorded from the Australian region. Millett's *Miliolina bosciiana*, agglutinated var. (*J.R.M.S.*, 1898, pl. vi, fig. 4) is perhaps the same as the present species. *Q. agglutinans* d'Orb. and *Q. bidentata* d'Orb., both of which were described from the West Indian region, and *Q. sclerotica* Karrer, from the Miocene

of Hungary, are proportionately wider, with a squarish periphery, and the apertural characters are different. Another form which is more closely related is *Q. anguina* Terquem, var. *agglutinans* (Wiesner), recorded by Heron-Allen and Earland from the Kerimba Archipelago, with the note that the Kerimba specimens agreed with co-types supplied by Wiesner. This is similar to Terquem's *Q. anguina*, from the Pliocene of the Island of Rhodes, except that there is a sub-arenaceous investment to the shell. The coarsely-arenaceous shell-wall of the present species separates it from Wiesner's form.

Genus **Spiroloculina** d'Orbigny, 1826.

SPIROLOCULINA ANTILLARUM d'Orbigny.

(Plate I, Fig. 11.)

Spiroloculina antillarum d'Orbigny, 1839, in De La Sagra, *Hist. Fis. Pol. Nat. Cuba*, "Foraminifères," p. 166, pl. ix, figs. 3, 4. Cushman, 1924, *Publ. 342, Carn. Inst. Wash.*, p. 55, pl. xx, fig. 1.

Stns. 1, 2, 3, 5, 6, 7, 8, 9, 10, 11. C. (as *S. grata*).

There are many fine examples of this species measuring up to 1.3 mm. in length. They vary considerably in width. The figured specimen is exceptionally broad, and in front view is like Fornasini's figure (*Mem. Acc. Sci. Ist. Bologna* [6], i, 1904, p. 5, pl. i, fig. 9) of *S. striata* d'Orb. from the Planches **Inédites**. In end view, however, that species has a subcarinate margin, while that of *S. antillarum* is rounded. Although Parker and Jones recorded *Spiroculina* (*sic*) *striata* d'Orb. from coast sand, Melbourne, no individuals with angular margins have been found in the present material.

S. antillarum is a common species in the warmer shallow-water areas of the Pacific. In Australia, it occurs as a fossil in the Lower Beds at Muddy Creek, near Hamilton, Vic. (Oligocene),

and in the Miocene of Table Cape, Tas.

Genus **Triloculina** d'Orbigny, 1826.

TRILOCULINA INSIGNIS (Brady).

(Plate I, Fig. 12.)

Triloculina striato-trigonula Parker and Jones, 1865, *Phil. Trans.*, clv, p. 438 (*nomen nudum*).

Miliolina insignis Brady, 1881, *Quart. Jour. Micr. Sci. (London)*, n.s., xxi, p. 45; 1884, *Rept. Voy. "Challenger," Zool.*, vol. ix, p. 165, pl. iv, figs. 8, 10.

Stns. 6, 7, 8, 9, 10, 11. P. & J.

There can be no doubt that this is the same species as that recorded by Parker and Jones as *T. striato-trigonula* nov., from coast sand, Melbourne, Australia, but as the latter was a *nomen*

nudum, Brady's name must stand. Brady's figures seem to represent two species. The present specimens are nearest his Fig. 10, the original of which was from Bass Strait. This is a common shallow-water form on the Australian coast. The other specimen figured by Brady (Fig. 8) was from the West Indies, 390 fms.

TRILOCULINA BERTHELINIANA (Brady).

(Plate I, Fig. 13.)

Miliolina bertheliniana Brady, 1884, *Rept. Voy. "Chall."* Zool., vol. ix, p. 166, pl. cxiv, fig. 2.

M. tricarinata (d'Orb.) (reticulated var.): Millett, 1898, *J.R.M.S.*, p. 503, pl. xi, fig. 12.

Stn. 7.

One typical example. The records of this species are all from the Indo-Pacific region, where it occurs in shallow water. The specimen figured by Brady was from shore sand, Tamatavé, Madagascar.

TRILOCULINA OBLONGA (Montagu).

(Plate I, Figs. 15a-c.)

Vermiculium oblongum Montagu, 1803, *Test. Brit.*, p. 522, pl. xiv, fig. 9.

Miliolina oblonga (Montagu): Williamson, 1858, *Recent Foram. Gt. Brit.*, p. 86, pl. vii, figs. 186, 187.

Stns. 1, 2, 3, 4, 5, 6, 7, 9. C., H.

Examples of this species are fairly common, and are nearly all of the narrow type figured by Williamson, with a few broader specimens approaching *T. laevigata* d'Orb. and *T. elongata* d'Orb. From Point Lonsdale, Vic., there are several examples of the biloculine form, which does not appear to have been recorded previously (Plate I, Figs. 15a-c).

TRILOCULINA CULTRATA (Brady).

(Plate I, Figs. 14a, b.)

Miliolina cultrata Brady, 1881, *Quart. Journ. Micr. Sci. (London)*, n.s., xxi, p. 45; 1884, *Rept. Voy. "Chall."* Zool., vol. ix, p. 161, pl. v, figs. 1, 2. Heron-Allen and Earland, 1915, *Trans. Zool. Soc., Lond.*, xx, p. 564, pl. xlii, figs. 1-5 (non figs. 6-10).

Stn. 3.

The figured specimen is the only one found, but it is very typical. Brady recorded this species from Humboldt Bay, Papua, 37 fms., and Calpentyn, Ceylon, 2 fms. Heron-Allen and Earland's record was from the Kerimba Archipelago, also from comparatively shallow water.

Family LAGENIDAE.

Sub-Family LAGENINAE.

Genus **Lagena** Walker and Jacob, 1798.

LAGENA DISTOMA-MARGARITIFERA Parker and Jones.

(Plate I, Figs. 16, 17.)

Lagena distoma-margaritifera Parker and Jones, 1865, *Phil. Trans.*, clv, p. 357, pl. xviii, figs. 6a. b. Brady, 1884, *Rept. Voy. "Chall."* *Zool.*, vol. ix, p. 458, pl. lviii, fig. 16.
Stns. 6, 7, 8, 9, 11. P. & J., H.

Occasional specimens occur. An exceptionally fine one from Point Lonsdale, found after the plates were drawn, is perfect and shows this species to have one end closed and the other produced to form a long neck with a phialine neck as in *L. gracillima*. It was described from the Victorian coast, and the only records of its occurrence are: Near Melbourne, from shore sand (Parker and Jones); off East Moneoer Island, Bass Strait, 38 fms., and off the west coast of New Zealand (Brady); and the mouth of the Port Adelaide River, S.A. (Howchin). The species is found fossil in the Balcombian of Grice's Creek, near Frankston, Vic.

LAGENA TETRAGONA Parker and Jones.

(Plate I, Fig. 18.)

Lagena tetragona Parker and Jones, 1865, *Phil. Trans.*, clv, p. 420, pl. xviii, figs. 14a, b.
Stn. 4.

This species does not appear to have been recorded since it was described from the Middle Eocene (Calcaire Grossier) of Grignon, France. The specimens from Williamstown agree exactly with the figures given by Parker and Jones.

LAGENA ACUTICOSTA Reuss, var. RAMULOSA Chapman.

(Plate I, Fig. 19.)

Lagena acuticosta Reuss, var. *ramulosa* Chapman, 1909, *Journ. Quek. Micr. Club*, [2], x (for 1907), p. 129, pl. ix, fig. 9.
Stns. 6, 7, 11. C.

Rare. The present records extend the range of this very distinct form to South Australian waters. It was described by Mr. Chapman from McHaffie's Reef, Phillip Island, and occurs also in the Post-Tertiary of Victoria.

Family POLYMORPHINIDAE,

Sub-Family POLYMORPHININAE.

Genus **Sigmomorphina** Cushman and Ozawa, 1928.**SIGMOMORPHINA WILLIAMSONI** (Terquem).

(Plate I, Fig. 20.)

Polymorphina lactea (Walker and Jacob), var. *oblonga* Williamson, 1858, Rec. Foram. Gt. Brit., p. 71, pl. vi, figs. 149, 149a.*P. williamsoni* Terquem, 1878, *Mém. Soc. Géol. France*, [3], i, p. 37.*Polymorphina oblonga* Will. (non d'Orbigny): Heron-Allen and Earland, 1922, Brit. Ant. ("Terra Nova") Exped., 1910, *Nat. Hist. Rep. Zool.*, vol. vi, pt. 2, p. 180, pl. vii, fig. 2.*Sigmomorphina williamsoni* (Terquem): Cushman and Ozawa, 1930, *Proc. U.S. Nat. Mus.*, lxxvii, Art. 6, p. 138, pl. xxxviii, figs. 3, 4.

Stns. 3, 4.

Four very typical examples were met with in the silty material from Hobson's Bay. This species is common around the British Isles. Heron-Allen and Earland's record quoted above is from off the coast of New Zealand. I have *S. williamsoni* also from a dredging off the Snares, S. of New Zealand, 60 fms., and as a fossil from the Miocene of Birregurra, Vic.

Family BULIMINIDAE.

Sub-Family VIRGULININAE.

Genus **Bolivina** d'Orbigny, 1839.**BOLIVINA SUBRETICULATA**, sp. nov.

(Plate I, Figs. 21a, b.)

Bolivina reticulata Brady (non Hantken), 1884, *Rept. Voy. "Chall."* *Zool.*, vol. ix, p. 426, pl. liii, figs. 30, 31.

Description.—Test small, in front view rhomboid, thickest along the median line and with sharp edges; chambers numbering about fourteen in the megalospheric form, but more in the microspheric form, much longer than wide, slightly inflated in the later portion of the test; sutures distinct, limbate, sinuous, with processes of varying length on the posterior margin; wall calcareous, finely perforate, and ornamented in the early part of the test with a few irregular costae, later with a network of raised lines formed by the projecting processes extending more or less across the face of each chamber; aperture bolivine, elongate-oval; colour white. Length about 0.35 mm.

Holotype (not figured) (Parr Coll.) from "Challenger" Station 185, off Raine Island, Torres Strait, 155 fms.

Remarks.—The present species is almost certainly the same as that figured by Brady as *B. reticulata* Hantken. The specimens

figured by him were from "Challenger" Stn. 177, off the New Hebrides. His records were from off the New Hebrides, 130 fms., off Raine Island, 155 fms., off Kandavu, 255 fms., off Tahiti, 420 fms., and from the South Atlantic, in mid-ocean, 1425 fms., the last-mentioned with a note that the specimens were not as typical as the others. Although Brady had examined specimens of *B. reticulata* from the *Clavulina szaboi* beds of Hungary, the only point of difference noted by him between these and the Recent form was the larger size of the fossil examples. His figures certainly do not agree with Hantken's (*vide Mitt. Ung. Geol. Anstalt*, iv (for 1875), 1881, p. 65, pl. xv, figs. 6a, b). I have recently received some material from the *Clavulina szaboi* beds in the vicinity of Budapest, and from this have obtained a good series of *B. reticulata*. The study of this leads me to regard the two forms as distinct. The Hungarian specimens in their earlier stages bear some resemblance to Brady's figures, but in the adult, instead of being in front view rhomboid, are broadest in the apertural half of the shell, while there is a much greater development of the reticulate ornament giving the species its name. In Recent specimens this is most conspicuous along the median line, and is nothing more than a development of the limbate sutures. In typical examples of *B. reticulata*, the whole of each face is closely and evenly ornamented with a network of raised lines which are independent of and largely obscure the sutures, and under this the surface is very finely, longitudinally striated. These striae are obscured by the more conspicuous ornament, and were apparently overlooked by Hantken, but are visible quite clearly on the last-formed two chambers under a magnification of 40 diameters.

The description of *B. subreticulata* is almost wholly based on a number of specimens from "Challenger" Stn. 185, off Raine Island, 155 fms. For these I am indebted to my friend, Mr. F. Chapman. Both megalospheric and microspheric stages are present, the latter having a longer test, with a larger number of chambers than the former, and resembling *B. reticulata* in being broadest in the apertural half of the shell. The figured example is a worn microspheric one from Point Lonsdale, Vic., drawn before those from Raine Island were studied. Others have since been found at the same locality, but not elsewhere on the coasts of Victoria and South Australia.

Sub-Family REUSSIINAE.

Genus *Reussia* Schwager, 1877.

REUSSIA DECORATA (Heron-Allen and Earland).

(Plate I, Figs. 22a, b.)

Vernuculina decorata Heron-Allen and Earland, 1924, *J.R.M.S.*, p. 138, pl. vii, figs. 7-9. Parr. 1926, *Vict. Nat.*, xliii, p. 18.

Stn. 4.

There is one small, but otherwise typical example of this species, which is now recorded for the first time in the Recent condition. The type-specimens were from the Miocene of the Filter Quarry, Batesford, Vic. I have examples from the same locality, and have recorded the species from the Oligocene of Muddy Creek, near Hamilton, Vic.

Explanation of Plate I.

- Fig. 1.—*Protonina spiculifera*, sp. nov. Point Lonsdale, Vic. Holotype. $\times 15$.
- Fig. 2a, b.—*Reophax friabilis*, sp. nov. Point Lonsdale, Vic. Holotype. Microspheric form. a, side view; b, apertural view. $\times 9$.
- Fig. 3.—? *Reophax scorpiurus* Montfort. Port Fairy, Vic. $\times 12$.
- Figs 4, 5.—*Clavulina multicamerata* Chapman. Port Fairy, Vic. Two specimens showing early angular chambers. $\times 24$.
- Fig. 6.—*Clavulina difformis* Brady. Gulf St. Vincent, S.A. $\times 24$.
- Fig. 7a, b.—*Cribrobulimina polystoma* (Parker and Jones). Glenelg, S.A. Example showing simple form of aperture. $\times 24$.
- Fig. 8a-c.—*Quinqueloculina australis*, sp. nov. Dredgings, 7 miles E. of Cape Pillar, Tas. Holotype. a, front view; b, rear view; c, view of apertural end. $\times 36$.
- Fig. 9.—*Quinqueloculina costata* d'Orb. San Remo, Vic. $\times 24$.
- Fig. 10a, b.—*Quinqueloculina ammophila*, sp. nov. Westernport Bay. a, rear view; b, end view (apertural end is broken off). $\times 24$.
- Fig. 11.—*Spiroloculina antillarum* d'Orb. Glenelg, S.A. Side view of an exceptionally broad specimen. $\times 24$.
- Fig. 12.—*Triloculina insignis* (Brady). Glenelg, S.A. $\times 24$.
- Fig. 13.—*Triloculina bertheliniana* (Brady). Torquay, Vic. $\times 36$.
- Fig. 14a, b.—*Tritoloculina cultrata* (Brady). Black Rock, Vic. a, front view; b, apertural view. $\times 36$.
- Fig. 15a-c.—*Triloculina oblonga* (Montagu). Point Lonsdale, Vic. Biloculine form. a, front view; b, side view; c, apertural view. $\times 20$.
- Figs. 16, 17.—*Lagena distoma-margaritifera* Parker and Jones. Point Lonsdale, Vic. Two examples showing different types of ornament. $\times 24$.
- Fig. 18.—*Lagena tetragona* Parker and Jones. Williamstown, Vic. $\times 60$.
- Fig. 19.—*Lagena acuticosta* Reuss, var. *ramulosa* Chapman. Point Lonsdale, Vic. $\times 48$.
- Fig. 20.—*Sigmomorphina williamsoni* (Terquem). Black Rock, Vic. $\times 48$.
- Fig. 21a, b.—*Bolivina subreticulata*, sp. nov. Point Lonsdale, Vic. Worn example of microspheric form. a, end view; b, side view. $\times 48$.
- Fig. 22a, b.—*Reussia decorata* (Heron-Allen and Earland). Williamstown, Vic. a, end view; b, side view. $\times 48$.